

WHAT IS CLAIMED IS:

1 1. A flexible medium transport simulation apparatus
2 which simulates transport of a sheet-like flexible medium
3 in a transport mechanism and three-dimensionally
4 displays the simulated transport, the apparatus
5 comprising:

6 a flexible medium setting section for setting the
7 length and the width of said flexible medium as
8 dimensional information, the length being a measurement
9 in a transport direction in which the flexible medium
10 is transported and the width being a measurement in a
11 widthwise direction which is perpendicular to the
12 transport direction with respect to a plane on which said
13 flexible medium is transported;

14 a transport path setting section for setting a
15 three-dimensional transport path covering a widthwise
16 deviation of said flexible medium, along which path said
17 flexible medium is transported in said transport
18 mechanism;

19 a travel amount information input section for
20 inputting travel amount information about an amount of
21 travel of said flexible medium;

22 a simulation section for simulating the transport
23 of said flexible medium carried out by said transport
24 mechanism, by using a three-dimensional mechanism model

25 of said transport mechanism being constructed inside said
26 simulation section;

27 a display for displaying the transport of said
28 flexible medium; and

29 a display control section for controlling said
30 display so as to display a result of the simulation
31 performed by said simulation section,

32 said simulation section comprising:

33 a position/posture computation section which
34 computes a three-dimensional transport position of said
35 flexible medium along the three-dimensional transport
36 path, and also computes a two-dimensional posture of said
37 flexible medium in a plane orthogonal to the widthwise
38 direction, on the basis of the dimensional information,
39 which is set by said flexible medium setting section,
40 of the three-dimensional transport path, which is set
41 by said transport path setting section, and of the travel
42 amount information, which is input by said travel amount
43 information input section; and

44 a three-dimensional image preparation
45 section which prepares a three-dimensional image of said
46 flexible medium on the basis of the three-dimensional
47 transport position or the two-dimensional posture, which
48 is computed by said position/posture computation section,
49 and of the dimensional information, which is set by said
50 flexible medium setting section, and outputs the

51 three-dimensional image as the result of the simulation.

1 2. A flexible medium transport simulation apparatus
2 according to claim 1, wherein

3 said travel amount information input section is
4 a pointing device adapted to be operated by a user, and
5 wherein

6 a three-dimensional image of said flexible medium
7 appearing on said display is operated by use of said
8 pointing device, with the result that the amount of
9 operation of the three-dimensional image is input to said
10 simulation section as the travel amount information.

1 3. A flexible medium transport simulation apparatus
2 according to claim 1, wherein

3 said travel amount information input section is
4 a pointing device adapted to be operated by a user, and
5 wherein

6 an image, appearing on said display, of a component
7 of said transport mechanism, which component acts on said
8 flexible medium, is operated by use of said pointing
9 device, with the result that the amount of operation of
10 the component image is input to said simulation section
11 as the travel amount information.

1 4. A flexible medium transport simulation according

2 to claim 1, wherein
3 said travel amount information input section is
4 a control program execution section which executes a
5 control program for controlling the operation of said
6 transport mechanism and computes an amount of control
7 of a component of said transport mechanism, which
8 component acts on said flexible medium, and wherein
9 the amount of control computed by said control
10 program execution section is input to said simulation
11 section as the travel amount information.

1 5. A flexible medium transport simulation apparatus
2 according to claim 3, further comprising a travel ratio
3 setting section which sets a travel ratio; i.e., a ratio
4 of a travel amount of said flexible medium to a rotation
5 amount of a roller, in a case where said transport
6 mechanism includes a roller which comes into contact with
7 and acts on said flexible medium, and wherein said
8 simulation section simulates transport of said flexible
9 medium on the basis of the travel ratio set by said travel
10 ratio setting section.

1 6. A flexible medium transport simulation apparatus
2 according to claim 4, further comprising a travel ratio
3 setting section which sets a travel ratio; i.e., a ratio
4 of a travel amount of said flexible medium to a rotation

5 amount of a roller, in a case where said transport
6 mechanism includes a roller which comes into contact with
7 and acts on said flexible medium, and wherein said
8 simulation section simulates transport of said flexible
9 medium on the basis of the travel ratio set by said travel
10 ratio setting section.

1 7. A flexible medium transport simulation apparatus
2 according to claim 5, wherein said travel ratio setting
3 section randomly sets the travel ratio in accordance with
4 a predetermined statistical distribution.

1 8. A flexible medium transport simulation apparatus
2 according to claim 6, wherein said travel ratio setting
3 section randomly sets the travel ratio in accordance with
4 a predetermined statistical distribution.

1 9. A flexible medium transport simulation apparatus
2 according to claim 1, wherein said simulation section
3 handles said flexible medium as a three-dimensional model,
4 the model being constituted by means of interconnecting
5 a plurality of strip-shaped members so as to be rotatable
6 about an axis parallel to said widthwise direction.

1 10. A flexible medium transport simulation
2 apparatus according to claim 1, wherein said transport

3 path setting section sets the three-dimensional
4 transport path through use of circular arcs and straight
5 lines.

1 11. A flexible medium transport simulation
2 apparatus according to claim 1, wherein said
3 position/posture computation section approximately
4 computes the two-dimensional posture through use of
5 circular arcs and straight lines.

1 12. A flexible medium transport simulation
2 apparatus according to claim 1, wherein said travel amount
3 information input section inputs the travel amount
4 information while a position of a load center of the force
5 applied for putting said flexible medium in motion is
6 made stationary on said flexible medium, and said
7 position/posture computation section computes the
8 two-dimensional posture based on the last-named travel
9 amount information and on the position of the load center
10 on said flexible medium.

1 13. A flexible medium transport simulation
2 apparatus according to claim 12, wherein, in a case where
3 said flexible medium is a notebook-shaped medium
4 consisting of a plurality of leaves, the position of the
5 load center is limited on an externally-exposed leaf of

6 said notebook-shaped medium.

1 14. A flexible medium transport simulation
2 apparatus according to claim 1, wherein said travel amount
3 information input section inputs the travel amount
4 information such that a position of a load center of the
5 force applied for putting said flexible medium in motion
6 is shifted on said flexible medium, and said
7 position/posture computation section computes the
8 two-dimensional posture based on the last-named travel
9 amount information while the position of the load center
10 on the flexible medium is perceived.

1 15. A flexible medium transport simulation
2 apparatus according to claim 13, wherein, in a case where
3 said flexible medium is a notebook-shaped medium
4 consisting of a plurality of leaves, page numbers are
5 assigned to respective leaves, and said position/posture
6 computation section perceives a leaf, on which the load
7 center is located, on the basis of the page number and
8 further perceives the position of the load center on the
9 leaf.

1 16. A flexible medium transport simulation
2 apparatus according to claim 1, wherein said
3 position/posture computation section computes the

4 three-dimensional transport position, through use of a
5 value which is obtained by adding a predetermined error
6 amount to the length of a predetermined portion of the
7 three-dimensional transport path, which is set by the
8 transport path setting section, to simulate deviation
9 of said flexible medium being transported through the
10 predetermined portion.

1 17. A flexible medium transport simulation
2 apparatus according to claim 16, further comprising an
3 error amount setting section for randomly setting the
4 predetermined error amount in accordance with a
5 predetermined statistical distribution.

1 18. A flexible medium transport simulation
2 apparatus according to claim 1, wherein, when said
3 flexible medium arrives at a predetermined position, said
4 position/posture computation section fixes the
5 three-dimensional transport position to the
6 predetermined position or computes the
7 three-dimensional transport position such that a
8 transport speed of said flexible medium is decreased,
9 to simulate the occurrence of troubles in transport of
10 said flexible medium at the predetermined position.

1 19. A flexible medium transport simulation

2 apparatus according to claim 18, further comprising a
3 position setting section which randomly sets said
4 predetermined position in accordance with a
5 predetermined statistical distribution.

1 20. A flexible medium transport simulation
2 apparatus according to claim 1, wherein said flexible
3 medium setting section further sets the thickness of said
4 flexible medium as the dimensional information about said
5 flexible medium, and said simulation section simulates
6 transport of said flexible medium in consideration of
7 the thickness set by said flexible medium setting section.

1 21. A method of simulating transport of a sheet-like
2 flexible medium in a transport mechanism and
3 three-dimensionally displaying the simulated transport,
4 the method comprising:

5 a flexible medium setting step for setting the
6 length and the width of said flexible medium as
7 dimensional information, the length being a measurement
8 in a transport direction in which the flexible medium
9 is transported and the width being a measurement in a
10 widthwise direction which is perpendicular to the
11 transport direction with respect to a plane on which said
12 flexible medium is transported;

13 a transport path setting step for setting a

14 three-dimensional transport path covering a widthwise
15 deviation of said flexible medium, along which path said
16 flexible medium is transported in said transport
17 mechanism;

18 a travel amount information input step for
19 inputting travel amount information about an amount of
20 travel of said flexible medium;

21 a simulation step for simulating the transport of
22 said flexible medium carried out by said transport
23 mechanism, with use of a three-dimensional mechanism
24 model of said transport mechanism; and

25 a display step for displaying the transport of said
26 flexible medium, simulated in said simulation step, on
27 a display,

28 said simulation step includes:

29 a position/posture computation step for
30 computing a three-dimensional transport position of said
31 flexible medium along the three-dimensional transport
32 path, and also computes a two-dimensional posture of said
33 flexible medium in a plane orthogonal to the widthwise
34 direction, on the basis of the dimensional information,
35 which is set in said flexible medium setting step, of
36 the three-dimensional transport path, which is set in
37 said transport path setting step, and of the travel amount
38 information, which is input in said travel amount
39 information input step; and

40 a three-dimensional image preparation step
41 for preparing a three-dimensional image of said flexible
42 medium on the basis of the three-dimensional transport
43 position or the two-dimensional posture, which is
44 computed in said position/posture computation step, and
45 of the dimensional information, which is set in said
46 flexible medium setting step, and outputting the
47 three-dimensional image as the result of the simulation.

1 22. A computer-readable recording medium which
2 stores a flexible medium transport simulation program
3 for instructing a computer to execute functions of
4 simulating transport of a sheet-like flexible medium in
5 a transport mechanism and of three-dimensionally
6 displaying the simulated transport, wherein

7 said flexible medium transport simulation program
8 instructs the computer to function as:

9 a transport path setting section for setting
10 a three-dimensional transport path covering a widthwise
11 deviation of said flexible medium, along which path said
12 flexible medium is transported in said transport
13 mechanism;

14 a travel amount information input section for
15 inputting travel amount information about an amount of
16 travel, starting from a predetermined position, of said
17 flexible medium;

18 a simulation section for simulating the
19 transport of said flexible medium carried out by said
20 transport mechanism, by using a three-dimensional
21 mechanism model of said transport mechanism being
22 constructed inside said simulation section; and

23 a display control section for controlling a
24 display so as to display a result of the simulation
25 performed by said simulation section,

26 the computer, when it functions as the simulation
27 section, being instructed to function as:

28 a position/posture computation section which
29 computes a three-dimensional transport position of said
30 flexible medium along the three-dimensional transport
31 path, and also computes a two-dimensional posture of said
32 flexible medium in a plane orthogonal to the widthwise
33 direction, on the basis of dimensional information set
34 in advance, of the three-dimensional transport path,
35 which is set by said transport path setting section, and
36 of the travel amount information, which is input by said
37 travel amount information input section; and

38 a three-dimensional image preparation
39 section which prepares a three-dimensional image of said
40 flexible medium on the basis of the three-dimensional
41 transport position or the two-dimensional posture, which
42 is computed by said position/posture computation section,
43 and of the dimensional information, and outputs the

